

Research at the Missouri Botanical Garden

Passifloraceae





Taxonomy – Tribe Paropsieae: >

Includes 6 genera: Androsiphonia (1

Paropsiopsis (7), Smeathmannia (2),

a primitive branch of Passifloraceae.

It is composed of shrubs and small

trees from Africa with unlobed leaves

and five to many stamens. Paropsia

sp.), Barteria (3), Paropsia (11),

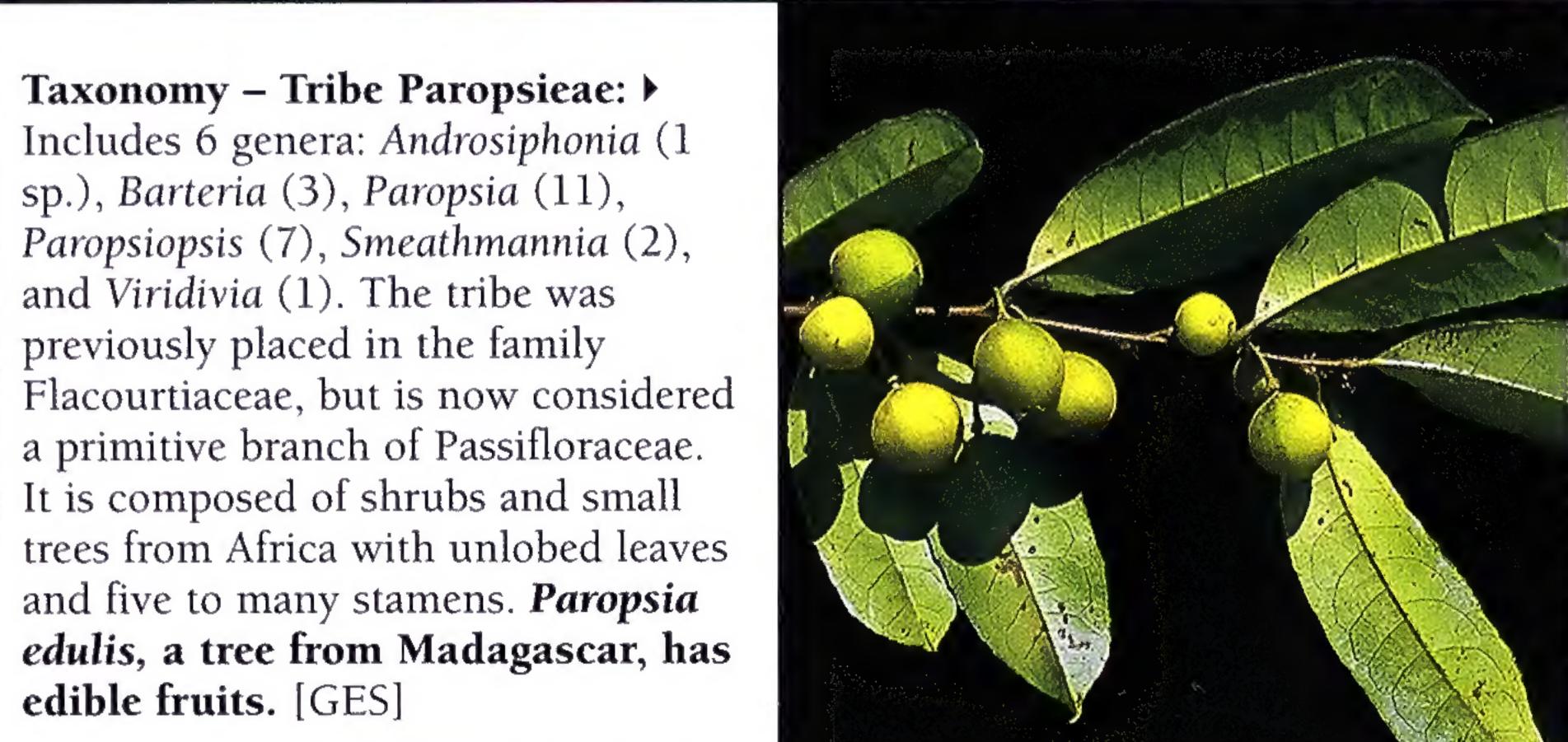
and Viridivia (1). The tribe was

previously placed in the family

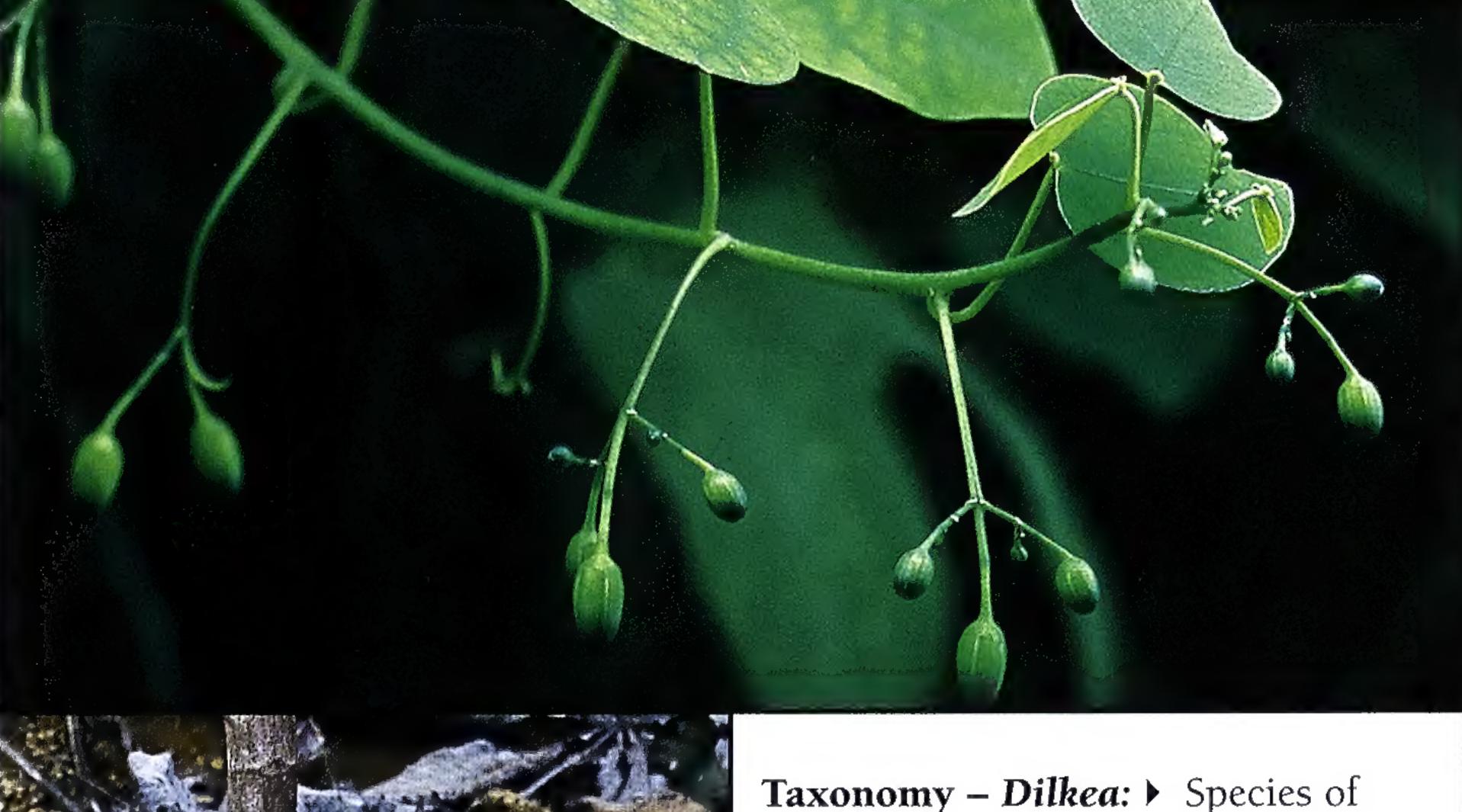
edible fruits. [GES]

♦ Passionflowers are a conspicuous component of the flora of the Neotropics. Their beautiful brightly colored flowers with unusual fringed coronas attracted the attention of the earliest explorers. Missionaries of the 1600s took the flower to symbolize the passion, or suffering, of Christ. They interpreted the coronal filaments as the crown of thorns, the stigmas as the nails, the anthers as the five wounds inflicted upon Christ. This symbolism, as seen in Passiflora serratodigitata [LEG], led to the name of the family and its most diverse genus. The family Passifloraceae includes about 660 species in two tribes: Paropsieae are shrubs and small trees, while Passifloreae are tendril-bearing climbers. All genera have a floral corona. MBG botanists John M. MacDougal and Peter M. Jørgensen are among the world's experts on Passifloraceae. They curate the collections at MBG and

do research on the Neotropical members of the family.



Taxonomy - Passiflora: > The largest genus, Passiflora, is divided into four subgenera. In subgenus Astrophea we find Passiflora amoena. This tiny tree from French Guiana flowers at the base of its trunk. Astrophea has several examples of trees and many lianas. Bee and hummingbird pollination are common. A few species have five nectar chambers vs. one in most Passiflora. The pollinating bird must enter the flower five times to drink all the nectar. [CF]



Taxonomy - Dilkea: > Species of Dilkea, here represented by Dilkea acuminata from Chocó, Colombia, are opportunistic lifeform shifters. Plants may start out as small trees or shrubs in the understory of the lowland rain forest. They flower and fruit in this state for years, and may never develop into their other form. If a treefall creates a light gap, the small tree sends out long shoots and the plant changes into a liana of the forest canopy. [AG]





▲ Taxonomy – Adenia: Many species of Adenia have unusual forms, with male and female flowers on different shoots or different plants, or they have their tendrils transformed into thorns. Perhaps the most peculiar are the species with large tuberous stems that can store water and nutrients. During the humid season, they send out vegetative and flowering shoots. Adenia aculeata grows in the deserts of eastern Ethiopia, Somalia, and northeastern Kenya. [MEO]



Economic – Invasive species: >

In Hawai'i a species of subgenus

Passiflora, 'banana poka', has been

introduced and is creating serious

enemies, it is very invasive and is

of hectares and is shading endemic

has long been controversial, but

Morphology – Flower: ▶

The hallmark of the family is the

corona, seen here in Passiflora alata

as purple-banded filaments that

extend outward like a cup. The

corona, more developed in insect-

pollinated species, is an outgrowth

at the base of the corolla. It carries

perfume, holds in nectar, acts as a

landing platform for pollinators, and

stamens are borne beneath the ovary

is a visual attractant. In Passiflora, the

problems. Removed from its natural

spreading rapidly. It covers thousands

species. The identity of this species

◆ Taxonomy – Passiflora: Passiflora discophora, subg. Deidamioides, is a small liana that climbs using tiny adhesive disks at the tips of its tendrils in a manner similar to Boston ivy. It flowers only 5–8 feet off the ground, but climbs much higher. It is known only from a few localities in coastal Ecuador and is threatened with extinction. The beautiful fruits are eaten by birds, which disperse the seeds. Less than 4% of the moist tropical forest remains in western Ecuador. [RB]

Economic – Medicines: > Passiflora incarnata, or maypop, is native to Missouri and the southeastern US. It is the type species of the genus. Extracts from the aboveground parts are used medicinally as a mild sedative. Commercial plantations have been started in Central America, where the plant can be harvested year round.

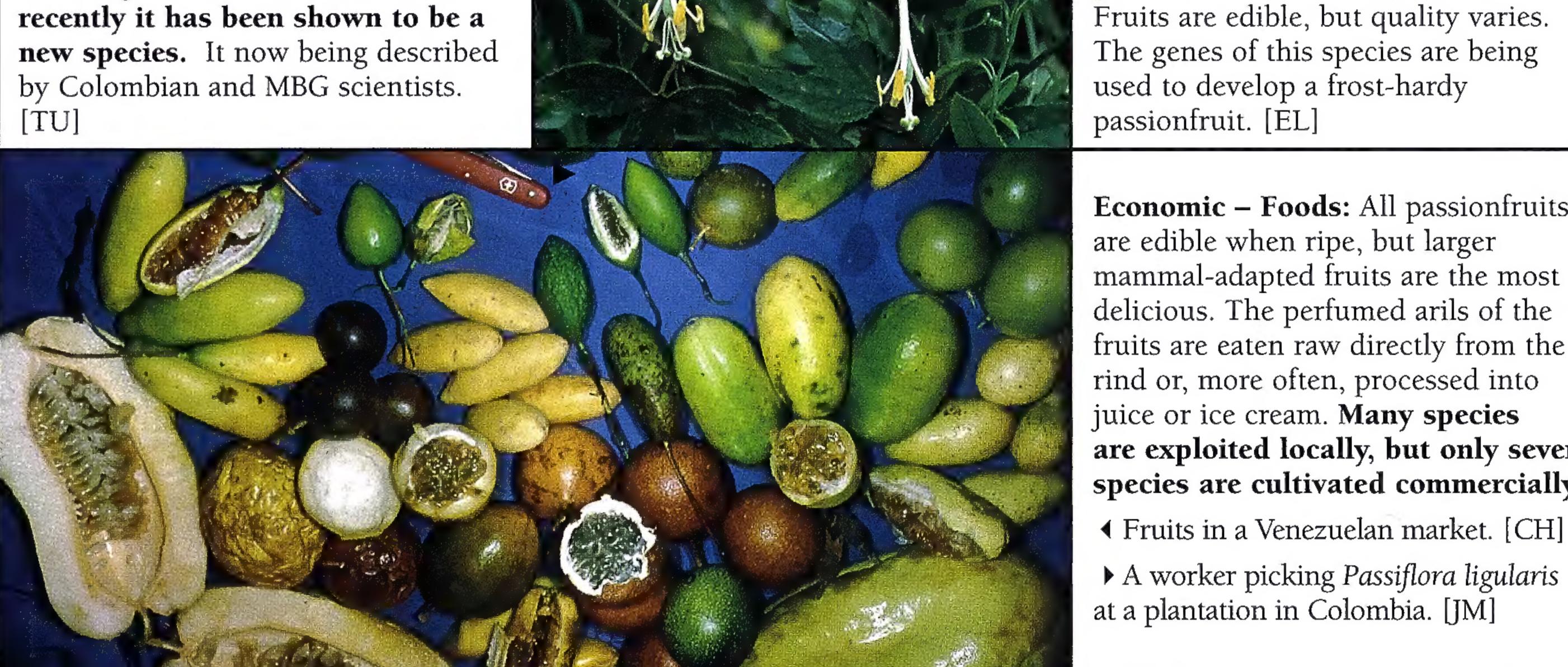


◀ Habitat – Distribution: The family grows in all the tropics and in many warm temperate areas, from humid rain forests to deserts along a humidity gradient, and from humid rain forest to temperate and montane forests along a temperature gradient. The highest diversity is found in Colombia's montane rain forests. The family can be found from the U.S. to Chile and Argentina, and from sub-Saharan Africa to Malaysia, Viet Nam, China, Australia, and New Zealand. Two species are native to Missouri. Species are known at 4000 m above sea level, but most inhabit warmer tropical forests like this near Lita, Ecuador [PMJ]. Many tropical forests are being converted to agriculture, but many species are able to maintain a presence in fences and small forest remnants.

Habitat - Old World Passiflora: > Passiflora herbertiana is an example of the 20 species found outside the Neotropics, in Southeast Asia, Oceania, and



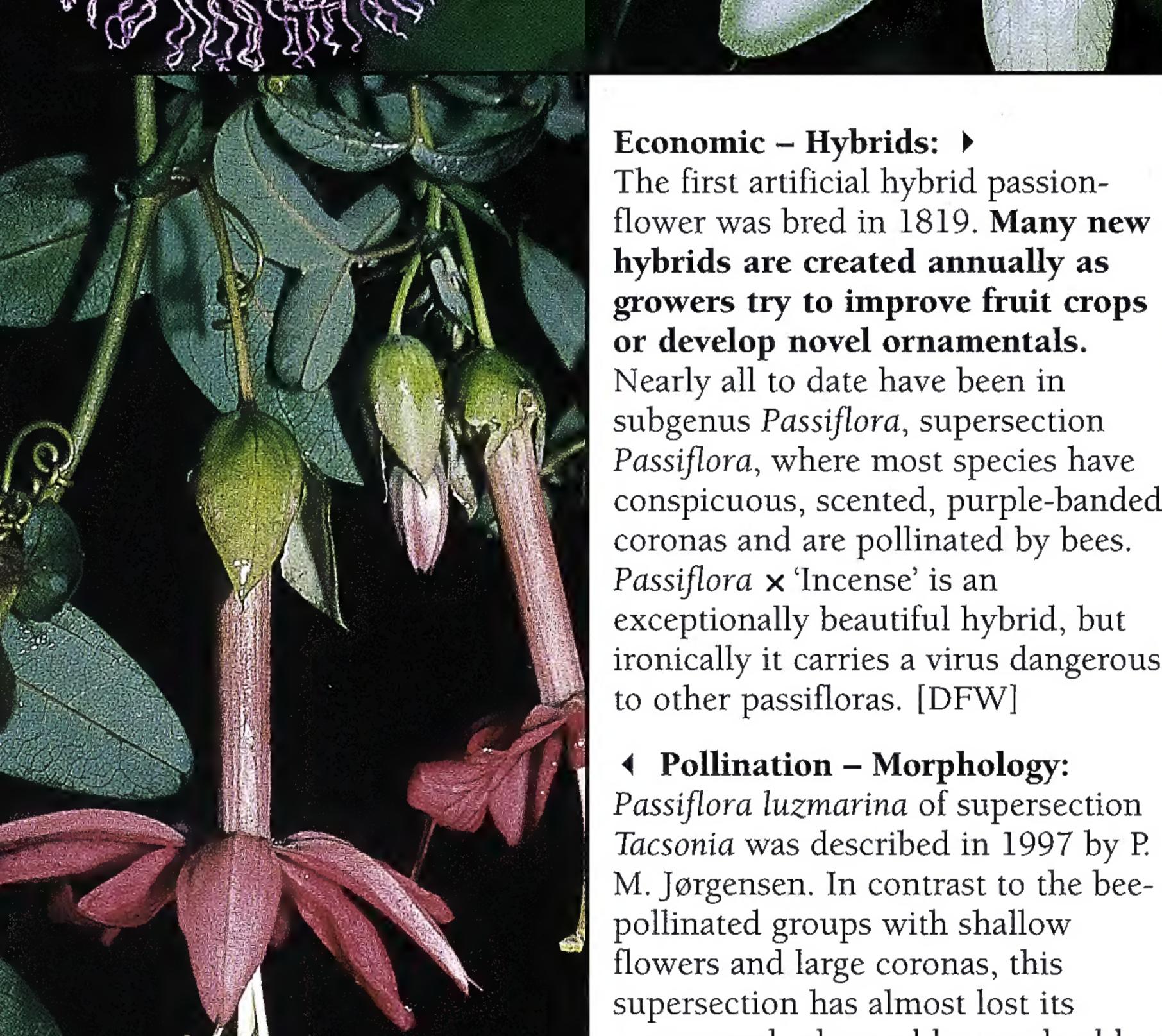
◆ Economic – Ornamentals: Passionflowers have been cultivated since 1609, when Passiflora incarnata was grown in Bologna. Many cultivars, sports, and hybrids have been produced, nearly all in the large-flowered subgenus Passiflora. The smaller-flowered species are grown mainly for their curious foliage. Left, the wild Passiflora allantophylla, subgenus Decaloba, on P. caerulea 'Constance Eliott', an old English cultivar. [JV]



Economic – Foods: All passionfruits are edible when ripe, but larger mammal-adapted fruits are the most delicious. The perfumed arils of the fruits are eaten raw directly from the rind or, more often, processed into juice or ice cream. Many species are exploited locally, but only seven species are cultivated commercially. ◆ Fruits in a Venezuelan market. [CH] ▶ A worker picking Passiflora ligularis at a plantation in Colombia. [JM]

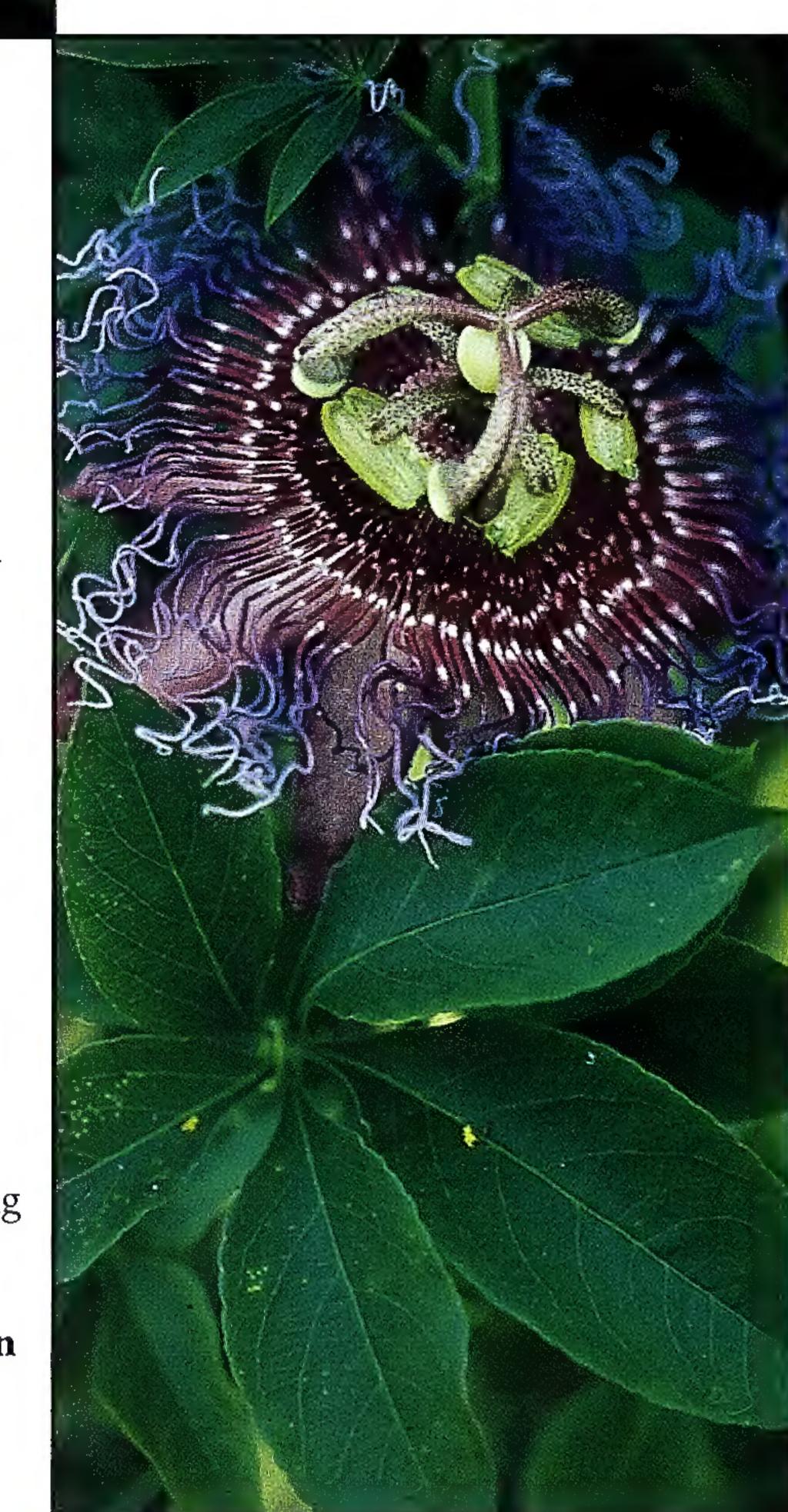


has berries while the other genera mostly have capsules. Seeds have a sculptured seedcoat and are surrounded by a juicy aril. Birddispersed passionfruits often are purplish with little odor, while mammal-dispersed species often are yellowish with an intense fruity aroma. Subgenus Decaloba usually has small purple or black berries. The colorful arils of Passiflora sicyoides suggests dispersal by birds. [JM]

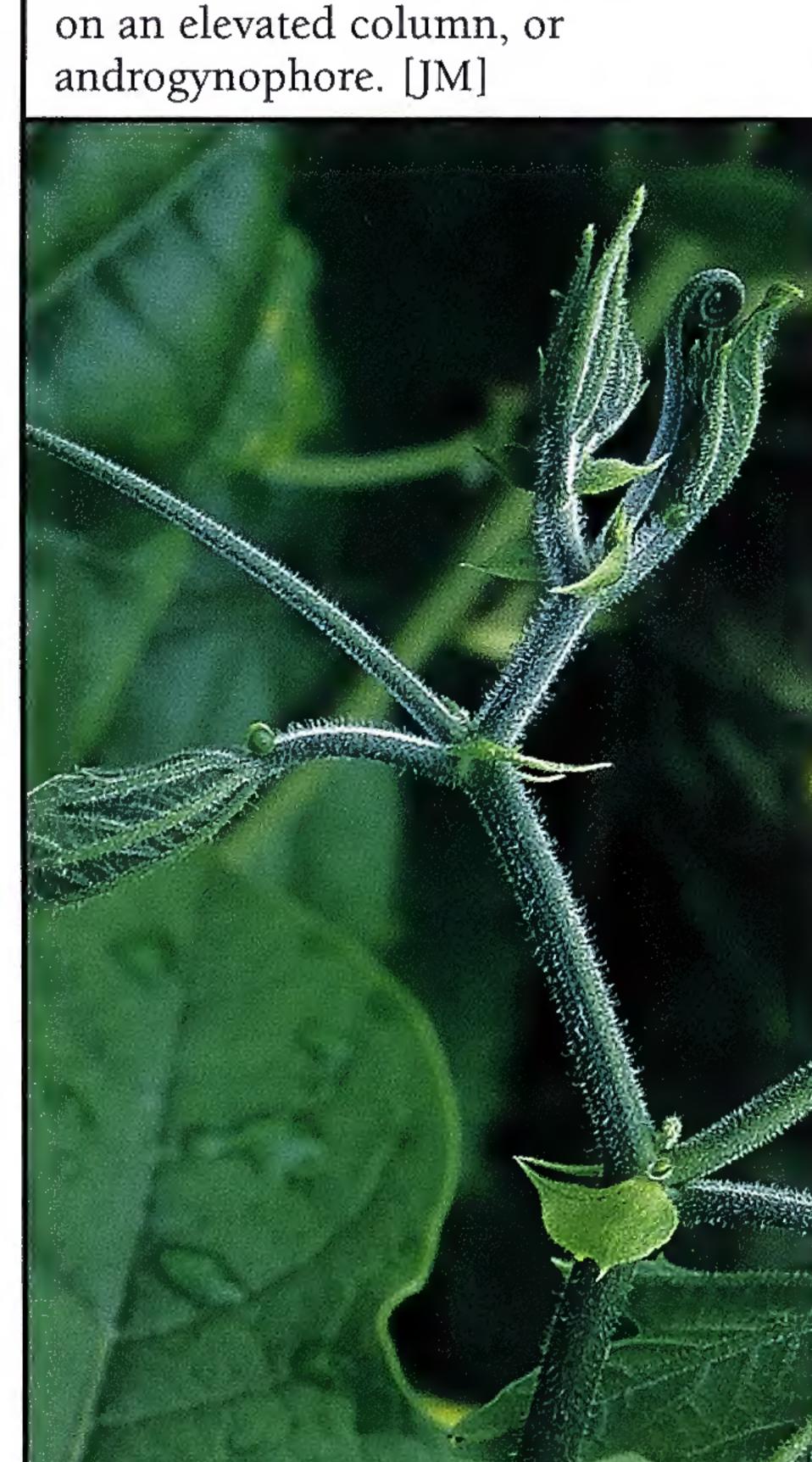


hybrids are created annually as growers try to improve fruit crops or develop novel ornamentals. Nearly all to date have been in subgenus Passiflora, supersection Passiflora, where most species have conspicuous, scented, purple-banded coronas and are pollinated by bees. Passiflora x 'Incense' is an exceptionally beautiful hybrid, but ironically it carries a virus dangerous to other passifloras. [DFW] • Pollination – Morphology:

Passiflora luzmarina of supersection Tacsonia was described in 1997 by P. M. Jørgensen. In contrast to the beepollinated groups with shallow flowers and large coronas, this supersection has almost lost its corona and odor and has evolved long floral tubes well adapted to pollination by hummingbirds. This species has been found only in a few fence rows in southern Ecuador and must be considered endangered. [GPL]



◀ Morphology – Life Form: A few species in subgenus Astrophea are small to medium trees with no tendrils at any stage. This habit is considered to be advanced in Passiflora. The trees, nearly all threatened with extinction, have small white flowers with a yellow corona, and most appear to be beepollinated. Two species in this group of trees have leaves that exceed one meter in length. One is seen here, Passiflora tica from Costa Rica. [LEG]



Diversity – Corona: >

The corona can have many shapes,

from long purple-banded filaments

Passiflora tulae, a species endemic to

Puerto Rico, has developed a tubular

structure by the fusion of its coronal

filaments. The effect is the same as a

shows another evolutionary pathway

prolongation of the floral tube, and

to hummingbird pollination.

to very small white teeth around

the opening of the floral tube.

◆ Morphology – Stem and Tendril: The shoot tip of Passiflora pendens, left, shows the alternate leaf arrangement and a tendril in each axil. In 98% of the species, the tendril is unbranched. Tendrils are derived from inflorescences. Passifloras range from 40 m lianas of primary rain forest canopy, to smaller forest edge vines, to tiny climbers. Lianas are very poorly understood throughout the world because the canopy is difficult to study. [JM]

▼ Morphology – Leaf Shape: Passionvines have the most diverse leaf shapes of any plant family on Earth; a few can be seen below, selected just from subgenus Decaloba. Cryptic camouflage and mimicry of other plants is thought to be very important in Passiflora. The variety of leaf shapes has evolved as a defense against heliconiine butterflies. These butterflies are long-lived and form search images in their quest for a host plant for their larvae. [LEG]



◆ Pollination – Bats: The Jamaican night-blooming passionflower, Passiflora penduliflora, is pollinated by the bat, Monophyllus redmani. The flowers, with reduced coronas, are pendent on long pedicels. Its putative sister species, Passiflora perfoliata, is hummingbird-pollinated. Studies by Elma Kay at MBG and St. Louis University are elucidating this ecological shift. Only a few species of passiflora are known to be bat-pollinated. [LEG]



Pollination – Bees, Birds, or **Bats**: Changes in pollinators have occurred various times in the genus. Passiflora roseorum, left, is an example of hummingbird pollination within subgenus Passiflora, where bee pollination dominates [GPL].

Passiflora citrina, of subgenus Decaloba, right, is **one of the few** yellow-flowered species and is hummingbird pollinated in a group where most species are pollinated by bees. [JM]



◆ Pollination – Bees, Birds, or Bats: Passiflora palmeri var. sublanceolata is a brilliantly colored bird-pollinated plant that arose from a bee-pollinated ancestor in the Passiflora foetida group of subgenus Passiflora. As with nearly all passionflowers, the flowers last less than one day. At least 12 hummingbird-pollinated lineages and 3 bat-pollinated lineages have arisen independently in the genus.



▼ Diversity – Flowers/Pollination: The wide range of floral colors, sizes, and shapes is related to **pollination**. Passiflora viridiflora from Pacific coastal Mexico, below, arose out of an insect-pollinated group of green-flowered species that lack petals and have small dish-shaped flowers. Here the flower is tubular, with a reduced corona. It is hummingbirdpollinated. Its bright red stems may assist in attracting humingbirds. [JM]



Diversity – Distribution: > Passiflora vitifolia is a typical example of a hummingbird-pollinated lowland rain forest species.[PMJ] It is widespread, found from Nicaragua to Peru. Such a distribution pattern is typical for many lowland species within and outside the family. The majority of passifloras are endemic species, such as Passiflora roseorum, above.

MBG researchers estimate that 30% of the species found in Ecuador are endemic to the country.



◆ Evolution – Defenses: Passifloras have evolved many defenses in response to their main enemies, the passionflower butterflies, or heliconiines. These insects lay their eggs only on passionvines. They search visually for the vines, resulting in intense selection pressure on the appearance and behavior of the plants. There is also much diversity in chemical, particularly cyanogenic, defenses. To the left is the heliconiine butterfly fauna of Corcovado National Park, Costa Rica. [LEG]

Egg mimicry is a striking visual example of a defense mechanism that evolved in response to herbivory. Egg mimics have evolved from several structures. In this case, yellow egg-like extrafloral nectaries trick the butterflies into laying their yellow eggs elsewhere. The female heliconiine butterfly sees the yellow glandular dots and interprets them as a competitor's eggs laid by another butterfly. She is likely to lay her eggs elsewhere. [LEG]



◆ Extrafloral Nectaries: Leaf-stalk glands of Passiflora oerstedii exude a sweet liquid rich in amino acids that attracts ants and wasps to patrol and protect the plants from herbivores. Nectaries outside the flower, typical in Passiflora, may be found on leafstalks, leaf edges and blades, stipules, bracts, and sometimes sepals. [LEG]

Bodygards – Ants: ▶ Ants take nectar from the pale marginal glands of bracts of Passiflora coccinea, Brazil. [LEG]



Research at the Missouri Botanical Garden

About 50 Ph.D.-level scientists, many of whom live abroad, assisted by about 80 technical staff and 25 graduate students, form the MBG Research Division. Their studies are concentrated on the plants of Mesoamerica, South America, Subsaharan Africa, Madagascar, China, Viet Nam, and North America. Individual MBG scientists are specialists in the plants of particular regions or in the classification of major plant families.

MBG serves as headquarters for the Center for Plant Conservation and for the major collaborative projects Flora of China and Flora Mesoamerica. To help

disseminate botanical information, MBG floristic research and library resources are available on the Garden Web site at http://www.mobot.org. MBG botanists collaborate with local institutions in each country where they

conservation policies to preserve global biodiversity.

conduct research, providing technical expertise, assisting with fundraising, establishing better communication with the worldwide scientific community, training botanists in the field and at MBG, and helping to build infrastructure. Botanical research provides basic scientific knowledge needed to develop

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